

Contour determination for ovate pontics

Tim J. Dylina, DDS^a

Merced, Calif.

The ovate pontic was initially described in 1933, but was only recently considered clinically acceptable. Historically, there has been resistance to ovate pontics, but this resistance lacks scientific and biologic evidence to justify rejection. Explicit instructions are mandatory for predictable results from dental laboratories. This article describes a method for communicating exact dimensions for an ovate pontic that was previously contoured for a patient in a provisional restoration to ensure clinical and histologic success. Polyvinyl siloxane putty is suggested as a matrix material for the predetermined contour. An esthetic and functional restoration will result when these materials and procedures are used in an appropriate sequence. (*J Prosthet Dent* 1999;82:136-42.)

The ovate pontic has been suggested as a more accurate duplication of emergence profile for natural teeth to provide an esthetic, cleanable prosthesis.¹⁻⁴ Ovate pontics can be inserted in posterior or anterior quadrants with equal success. However, the anterior quadrant presents the ultimate esthetic challenge. Historically, anterior pontic types have included the denture base, the ridge lap, the modified ridge lap, and the ovate pontics (Fig. 1). The denture base pontic (Fig. 1, A) was developed to enhance esthetics but severe obstacles resulted with flossing and poor tissue health,⁵ and was limited to the shape of edentulous ridges. The ridge lap pontic (Fig. 1, B) was designed to improve ease of cleaning but perpetuated hygienic problems with certain alveolar ridge contours. The modified ridge lap pontic (Fig. 1, C) was introduced to improve ease of cleaning; however, its design commonly created lingual food traps and phonetic difficulties when pushing air and saliva from the lingual surface. The ovate pontic (Fig. 1, D), which emerged from these limitations, was first described by Dewey and Zugsmith⁶ in 1933, but only recently considered a clinical alternative for optimal esthetics. Their study was limited to an extraction site and modified by other investigators to include the edentulous ridge.

As early as 1928, Reichenbach⁷ suggested that porcelain pontics should not be extended into alveolar post extraction sites, but the study was anecdotal. Irving⁸ stated that "while its field of usefulness is very limited there, however, is an occasional situation which, when carefully selected and executed, produces an ideal result. This porcelain root-tip restoration should never be used except in supplying one single anterior tooth."

Dewey and Zugsmith,⁶ who advocated that socket health could only be properly evaluated histologically, experimented with dogs to validate their clinical observations. These authors observed that "for years Brill⁹ has made use of long porcelain roots for fixed bridge-

work (1 to 2 mm from the base of the extraction socket) apparently with good clinical results." They also stated "the histologic finding in our experiment revealed the tendency of epithelium to cover wound surfaces from the margin, not only in simple extraction wounds but also in empty sockets into which porcelain roots have been imbedded." Loos and Gross¹⁰ conducted histologic experiments with humans, and noted that smaller extraction wounds were completely covered with a delicate epithelial film in approximately 1 week. The final conclusions of Dewey and Zugsmith⁶ were as follows:

According to our findings the length of the porcelain root is not the factor for discrimination that it is reputed to be. The good clinical results obtained by Brill in a practice of root implantation carried on for years are corroborated by the histologic findings in our experimental work. There is therefore no reason for rejection of this method which owing to the absence of recession of gingival tissue and bone resorption has special esthetic and hygienic advantages.

Stein⁵ used the incomplete work of Reichenbach⁷ and an alternative study by Dewey and Zugsmith⁶ in which they cautioned "when conditions are very unfavorable" to dismiss the ovate pontic as an alternate for traditional anterior pontics. This literature deduced that the shape of a pontic alone dictated adjacent tissue health. The study was expertly conducted and scientifically valid, except for 1 limitation. The only mention of hygiene adjacent to the pontic/tissue interface by Stein⁵ was "attempts to counteract the ill effects of the ridge lap design with dental floss to improve hygiene only added to the intensity of the inflammation." Passage of dental floss beneath a ridge lap pontic into inflamed tissue encouraged additional deterioration of tissue, which led to the erroneous conclusion that pontic design alone determined adjacent tissue health.

^aPrivate Practice.

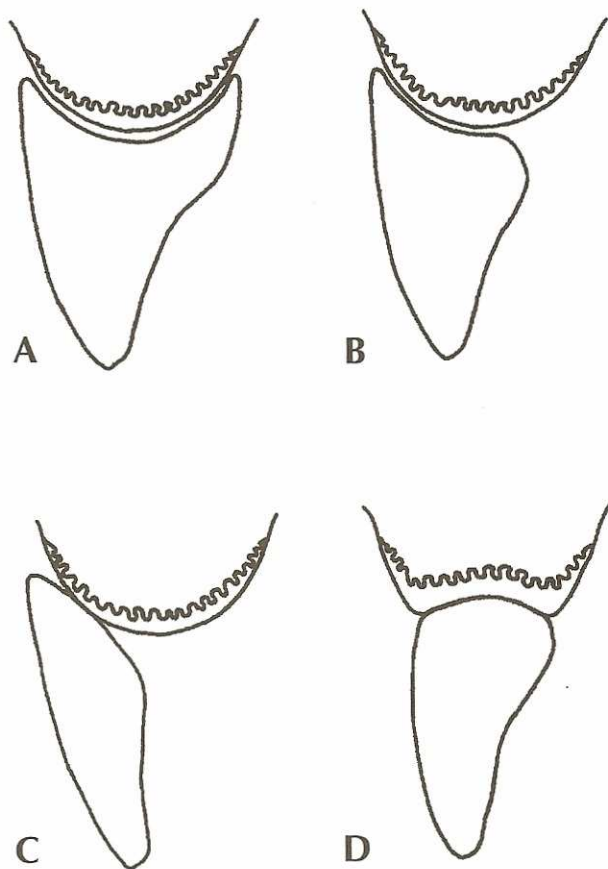


Fig. 1. Anterior pontic forms. A, Denture base; B, ridge lap; C, modified ridge lap; D, ovate.

There are few histologic studies regarding the apical sites of an ovate pontic. The science of wound healing can provide guidelines for research in this area. When teeth are extracted or a mechanical pontic site is formed, wound healing by secondary intention begins immediately, and a fibrin clot forms initially at and below the surface. Epithelialization begins at the edges of the wound and progresses in a sheet of cells toward its center.¹¹ The movement of the cells is based on the orientation of the fibrin clot and continues until other epithelial cells are encountered.¹² After the wound is covered, this thin layer of epithelial tissue differentiates and remodels into a stratified squamous epithelium. The time required for complete healing is dependent on the distance the epithelial cells have to migrate on the surface, the coagulum removed by polymorphonuclear neutrophils (PMNs) and macrophages before connective tissue healing, and the bacteria and debris at the wound site. The correlation in the research of Dewey and Zugsmith⁶ was evident.

This scientific information lent credence to the theory that a highly polished ovate pontic can act as a matrix for formation of stratified squamous epithelium.



Fig. 2. Ideal ovate pontic indication in patient who refused implant therapy.

Cervical repair is dictated by the level of the fibrin clot that can be dictated by the apical pontic height at any level. Emergence profile, embrasures, esthetics, and hygiene access are the responsibility of the attending dentist who prescribes the strategic details to the dental laboratory.

There are numerous articles that advocate a passive ridge contact for pontics^{6,13,14}; however, recent data and experience have indicated that active contact may be better. Tripodakis and Constantinides¹⁵ evaluated tissue response to hyperpressure from convex pontics with differing conditions of oral hygiene. Pressure was the maximum allowed by the resilience of tissue so that the satisfactory fit of the abutments would not be compromised. "Clinical and histologic findings showed the hyperpressure from smooth, polished and glazed convex metal ceramic pontics with excellent plaque control does not introduce inflammation to the adjacent tissues. However, if flossing the areas of hyperpressure does not take place, inflammation is inevitable."¹⁵

The tissue surface of the pontic is commonly responsible for the biologic reaction of adjacent soft tissue. The stimulation of active contact along with the occlusal forces could enhance tissue tone and health, as long as the pressure is amenable to passing dental floss unimpeded over the pontic. It also has been suggested that another advantage could be lateral esthetic tissue support and food deflection.¹⁶ The axial contours of the pontic must form a deflection ridge to prevent food impaction, yet remain subtle enough to provide a massaging action to the gingiva. The contour of the ovate pontic, which most closely mimics the natural tooth, satisfies these criteria. The Silness et al¹⁷ study demonstrated that the design of the pontic alone did not prevent inflammation of tissues but plaque and calculus removal with fastidious oral hygiene ensured healthy tissue responses.

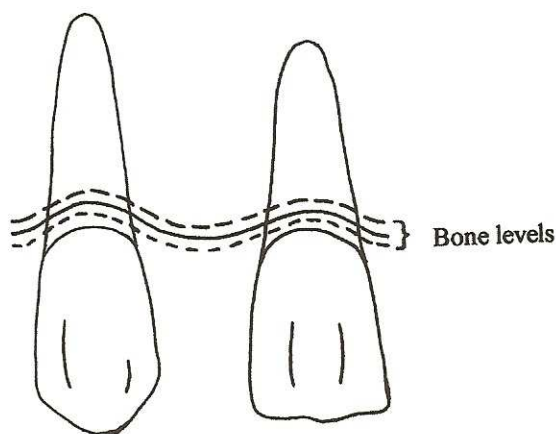


Fig. 3. Rendition of normal, high, and low crest bone.

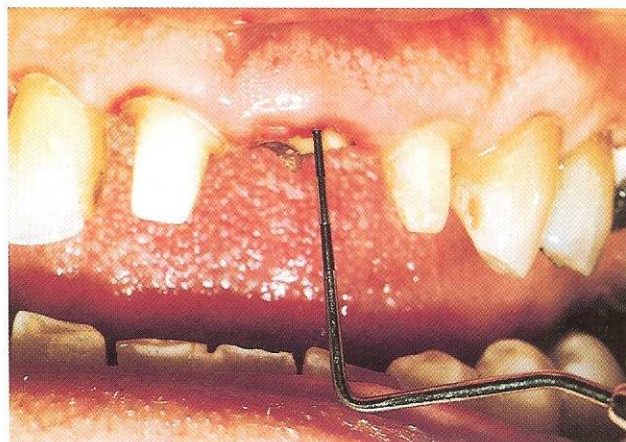


Fig. 4. Gauging bone height with periodontal probe (different patient).

Indications for ovate pontics are similar to a single tooth implant, namely, a tooth fractured at the tissue crest because of trauma, dental caries, or structural defects, has an intact buccal plate and adjacent teeth that require restoration. Indications for an ovate pontic also include medically compromised or unwilling patients for implant therapy or any pontic area in which natural emergence profile can create an esthetic advantage (Fig. 2). Contraindications include facial/lingual or coronal/apical ridge height inadequate to create bone and tissue contours necessary to mimic the den-
toringingival complex (DGC). In these instances, tissue and/or bone augmentation is performed, but these clinical conditions are beyond the scope of this article.

Pontic design is initiated at the treatment planning stage with the use of Triad VLC provisional material (Dentsply Int, York, Pa.) or wax formations on working models mounted in centric relation.¹⁸ This approach assists in the determination of the appropriate pontic height, width, depth, emergence profile, embrasure size and shape, apical contour, lingual contour, and occlusion for an artificial tooth. The final determinants are recorded intraorally by inserting the provisional restoration and are verified by the patient for suitable esthetics, phonetics, ease of cleaning, and comfort. The treatment restoration can also provide a stent for DGC healing and formation.

Pontic height is determined incisally by the phonetic, esthetic, and occlusal requirements in centric, protrusive, and laterotrusive movements. The width of the ovate pontic provisional restoration should be determined by proximity of adjacent teeth, appropriate gingival embrasure shape to ensure esthetics, ease of cleaning, and disguise of unfilled gingival embrasures. This width will determine final bony contour and papilla height after healing. The papilla should be supported proximally to develop a pointed papilla appearance that

provides the tissue and restoration with a natural appearance. Apical pontic height is determined by the existing tissue/bone complex, esthetic support and proximity to the tissue/bone interface for ease of cleaning, and prevention of food impaction. Passive ridge contact is indicated for most pontic forms,¹⁸ but the ovate pontic requires intimate contact to support, form, and protect tissue. Minimal alveolar bone loss will occur while remodeling after extraction (no loss of buccal, lingual, or interproximal bone plates) if no tissue incisions are made.

The existing DGC may include a normal high or low bone crest¹⁹ (Fig. 3) that can only be determined by gauging tissue to bone with a periodontal probe (Fig. 4). The patient with a high crest of bone can have greater cervical bone level than normal, so less pontic depth is necessary or possible. The patient with a low crest of bone can require greater tissue support, both laterally and facioloingually, which could necessitate a slightly apically extended pontic. Clinical experience has confirmed that when the pontic depth was excessively long, healing of the apical tissue was prolonged up to 2 years. In a normal edentulous ridge, the pontic apex should be 1 mm or more from the bone. In the normal crest, immediate extraction site a length of 3 mm from the most cervical tissue ridge to the pontic apex is appropriate to ensure a healthy, esthetic, and stable DGC. The emergence profile is dictated by facial and interproximal esthetic requirements of the patient. Food impaction is the main concern on the lingual surface of most pontic forms, in addition to expelling excess air and saliva from lingual to facial surfaces, which creates a potential phonetic problem. The ovate pontic satisfies this concern with possession of a natural emergence form (Fig. 5).

After functional and esthetic requirements are calculated on a working model, this resultant form is fabri-



Fig. 5. Lingual contour formed with provisional ovate pontic.



Fig. 6. Healing of site of ovate pontic 2 months after extraction.

cated with a provisional restoration. This interim restoration is used as a stent during tissue and bone healing while providing esthetics. The healing time of extraction can be estimated at 110 to 120 days with some patients who require up to 12 months or more. Postoperative healing of a patient is evaluated by a review of embrasure spaces, tissue support, esthetics, ease of cleaning, and healing (Fig. 6). If all criteria were satisfactorily addressed, an ovate pontic circumferential index is fabricated for the dental laboratory. If certain criteria are unsatisfactory, these omissions are corrected on the provisional restoration to resolve the problem. Dawson²⁰ illustrated a method to transfer information regarding the incisal, facial, and lingual surfaces of an anterior prosthesis to assist dental laboratories. This uncomplicated method can provide specific gingival and apical contour information.

The quality of communication between the dentist and the dental laboratory determines the ultimate success of a restoration. This article describes a method of



Fig. 7. Initial tooth preparations adjacent to compromised tooth.

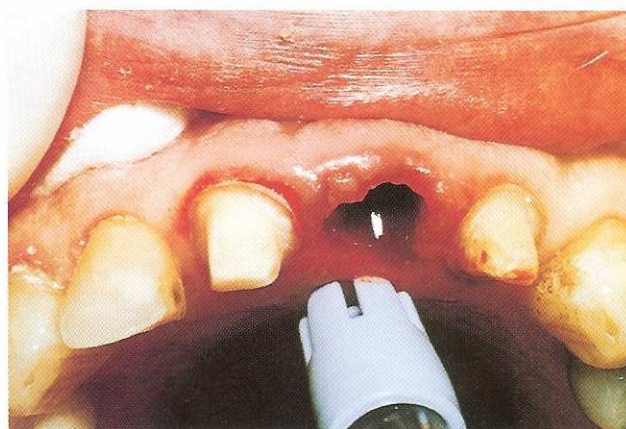


Fig. 8. Preservation of borders of extraction site.

communication with the dental technician to construct a contoured ovate pontic for appropriate tissue support, esthetics, comfort, and ease of cleaning.

OVATE PONTIC FORMATION PROCEDURES

Extraction socket

1. Prepare teeth to final tooth preparation adjacent to the extraction tooth. (Shoulder tooth preparations that preserve the biologic width are indicated [Fig. 7].)
2. Make an irreversible hydrocolloid (Acculoid, Van R, Oxnard, Calif.) impression of the tooth preparations and future extraction sites, including 2 teeth on either side distal to the tooth preparations.
3. Extract tooth internally to protect lateral papillae and buccal/lingual plates (Fig. 8).
4. Pour the impression in fast setting die stone (Snap Stone, Whip Mix Corp, Louisville, Ky.) of choice.

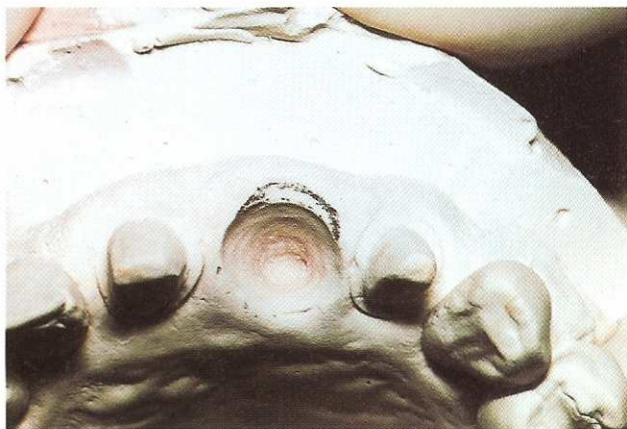


Fig. 9. Tooth preparation of pontic site in die stone to preserve normal anatomic contours.



Fig. 10. Gross provisional pontic illustrates apical pontic extension measured from cervical margin.



Fig. 11. Repolished provisional ovate pontic apex after 1 month.



Fig. 12. Ovate pontic site 3 months post extraction shows shrinking of tissue adjacent to preparations.

5. Fit stent made from stone model of the wax-up over stone model of the impression to verify stable fit and preparation reduction. Use acrylic resin trimming bur to form pontic site in stone (Fig. 9). Use extension concepts to mimic natural adjacent teeth. Coat stone preparations and ovate pontic site with separating media.
6. Mix provisional material to a viscous state and pour it in the stent. Orient it on the stone cast, and fit preformed Grey Rock gypsum stone (Accurate Set Inc, Newark, N.J.) over the stent with rubber bands tying the stent, cast, and Grey Rock gypsum stone together. Place in a pressure pot at 20 lb for 20 minutes.
7. Trim flash from the provisional restoration, slightly relieve the internal surface of tooth preparations and then seat it. Adjust the pontic for correct depth, facial and lingual extensions, embrasures, and occlusion (Fig. 10).

8. Cement the provisional restoration with an interim cement of choice.
9. Monitor at monthly intervals by removing the provisional restoration, checking the ovate pontic sight for proper healing verified by no ulceration or extravasation of blood vessels, pink healthy tissue, and minimal tissue rebound. Repolish the ovate pontic apex at each visit (Fig. 11).
10. When healing is finished, minor preparation may be necessary because of tissue shrinkage (Fig. 12). Refinement of the provisional (the pontic apex must not be touched) restoration to ensure marginal fit and contour can ensure a precise duplication model for the definitive prosthesis (Fig. 13).

Edentulous ridge with adequate form

1. Prepare teeth to final form of tooth preparation and gauge bone depth with a periodontal probe at the proposed pontic apex site.
2. Prepare the pontic site with an electrosurgical,

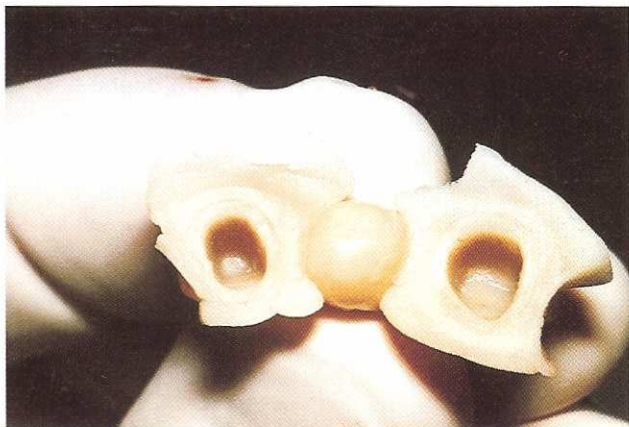


Fig. 13. Methyl methacrylate resin shim for refined margins of FPD abutment.



Fig. 14. Model of ovate pontic circumferential index immediately after removing temporary.

round diamond bur or soft tissue laser. The dimensions of the site must create appropriate depth, papillary support, and emergence profiles to mimic adjacent teeth. The pontic site depth should be no closer than 1 mm from the bone to ensure suitable healing.

3. Follow steps 2 through 10 of the extraction socket procedure.

Ovate pontic circumferential index

1. Remove the final provisional anterior fixed partial denture (FPD) and cleanse thoroughly.
2. Place a mix of Express putty (3M Dental Products, St Paul, Minn.) in a rectangular form slightly longer than the FPD and 1 × 1 cm in height and width. Have a dental assistant simultaneously inject green light body polyvinyl siloxane impression material (3M, Dental Products) in the internal surface of provisional abutment restorations and on the tissue-bearing surfaces of the pontic.



Fig. 15. Seated final FPD on trimmed and notched ovate pontic index.



Fig. 16. A, Final FPD on day of seating. **B,** Pontic at 1 year after surgery demonstrates papillary forms.

3. Place the provisional gingival surface in the putty to three-quarter depth of the entire pontic. Wait 5 minutes, then remove (Fig. 14).
4. Trim seating area of abutments to ensure seating without rocking.

5. Provide the dental laboratory technician with instructions to duplicate exactly this form and fill the entire pontic space without voids and return the circumferential index for final inspection (Fig. 15).

DISCUSSION

This article presents a rationale for selection of ovate pontics as an alternative to traditional pontic forms in anterior quadrants. Historical arguments to use other types of anterior pontics have not always been based on scientific data. A method for the fabrication of an acceptable ovate pontic, previously developed intraorally with a provisional restoration as a template, was also described. If precise attention to detail is exercised by a dental laboratory technician, a predictable final FPD can be consistently accomplished (Fig. 16, A and B).

There are many advantages to this procedure. Alveolar ridges with excessive buccal bone will extend a conventional pontic buccally from the neutral zone and this procedure allows for immediate replacement of a "questionable" tooth that is stable. Time is allowed for necessary healing to verify esthetics, phonetics, and comfort factors. With this procedure, when a condemned tooth is removed carefully by restorative dentists, they can control tissue and bone contours. Ease of cleaning is technically easier than in other pontic forms with appropriate formation of the apex of the provisional restoration. Alternative treatments may include a removable prosthesis, implants, Maryland FPDs, or conventional FPDs with various types of pontics.

However, there are some disadvantages to this procedure as well. Patients may be reluctant to accept tooth preparations lateral to the lost tooth. Pontic formation is time-consuming. Detailed attention to the existing provisional restoration is necessary for an acceptable marginal fit to transfer the FPD to the index for reproduction. Final impressions for the FPD should be made immediately after removal of the provisional restoration or tissue can "rebound" and create an ovate pontic space on the model substantially more shallow than the actual provisional pontic. This can result in an inaccurate relationship if the circumferential pontic index was not duplicated exactly because the working model is critical for the dental laboratory technician.

SUMMARY

A historical and biologic perspective has been presented to provide clinicians with a scientific basis for the use of the ovate pontic. A method of transferring exact details of this pontic form to dental laboratory techni-

cians has also been demonstrated. Final success of this prosthesis will rest with the oral hygiene practices of the patient. Daily, meticulous cleaning with dental floss to provide continuous moderate pressure against the apex of the pontic and abutment connectors will ensure optimal tissue health.

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Reprint requests to:

DR TIM J. DYLINE
1132 OLIVEWOOD DR
MERCED, CA 95348
FAX: (209)723-4823
E-MAIL: TimGolf2@aol.com

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